Simple Low Frequency Triggered Sweep Generator, *RevA*

On the next page is a simple ramp generator I cobbled up to allow a triggered sweep on older model recurrent / sync'ed sweep oscilloscopes. The goal of the project was to re-create the simple add-ons popular in the 70s and 80s. I first spent some significant time looking for old circuits, but came up empty. *(a kind Usenet user posted an extremely simple circuit from Electronics, see page 3)*. This is then what I came up with.

RevA modified the circuit somewhat to work better with my CRT. (italics mean RevA)

The basic concept of a sweep generator is that only one ramp be created per trigger and that further triggers be inhibited (held-off) until the ramp has retraced. Most discrete designs use a version of a direct-coupled monostable. It turns out that the CMOS 4538B does what I needed and is dirt cheap (already had some in the junk box). *RevA modifies the circuit by adding CR9 and associated components to provide an analog hold (the input to the 4538 is a schmitt trigger, so this works). Upon receipt of a new trigger, after the hold-off period, the display is left blanked (by or'ing of U1A and U1B outputs with CR7 and CR8) until the ramp has started.*

U1A is set up as a non-retriggerable monostable. The timing resistor has been replaced by the constant current source of Q3 and related components. R1 is a variable resistor allowing continuous adjustment of the ramp speed, in conjunction with the timing capacitors C5 and C6. R1 allows an adjustment range of 1x to 100x, and switching S1 in changes the capacitance by 100x, so the total timing range is 10,000:1. Q1 buffers the output of the ramp and provides a positive going ramp from approximately Vss to 0.7Vdd.

The *time-out* of U1A generates a *50µs "ramp on delay"* pulse from U1B. This might be longer than necessary, but it was convenient based on values already in the circuit. *The pulse is or'ed with the output of U1A to produce the z-axis blanking pulse,* buffered by Q2 and presented as a negative going pulse from approximately Vdd to Vss. *The blanking isn't really needed for most use, as the "blanked" part of the trace is quite dim as it moves quickly across the screen.*

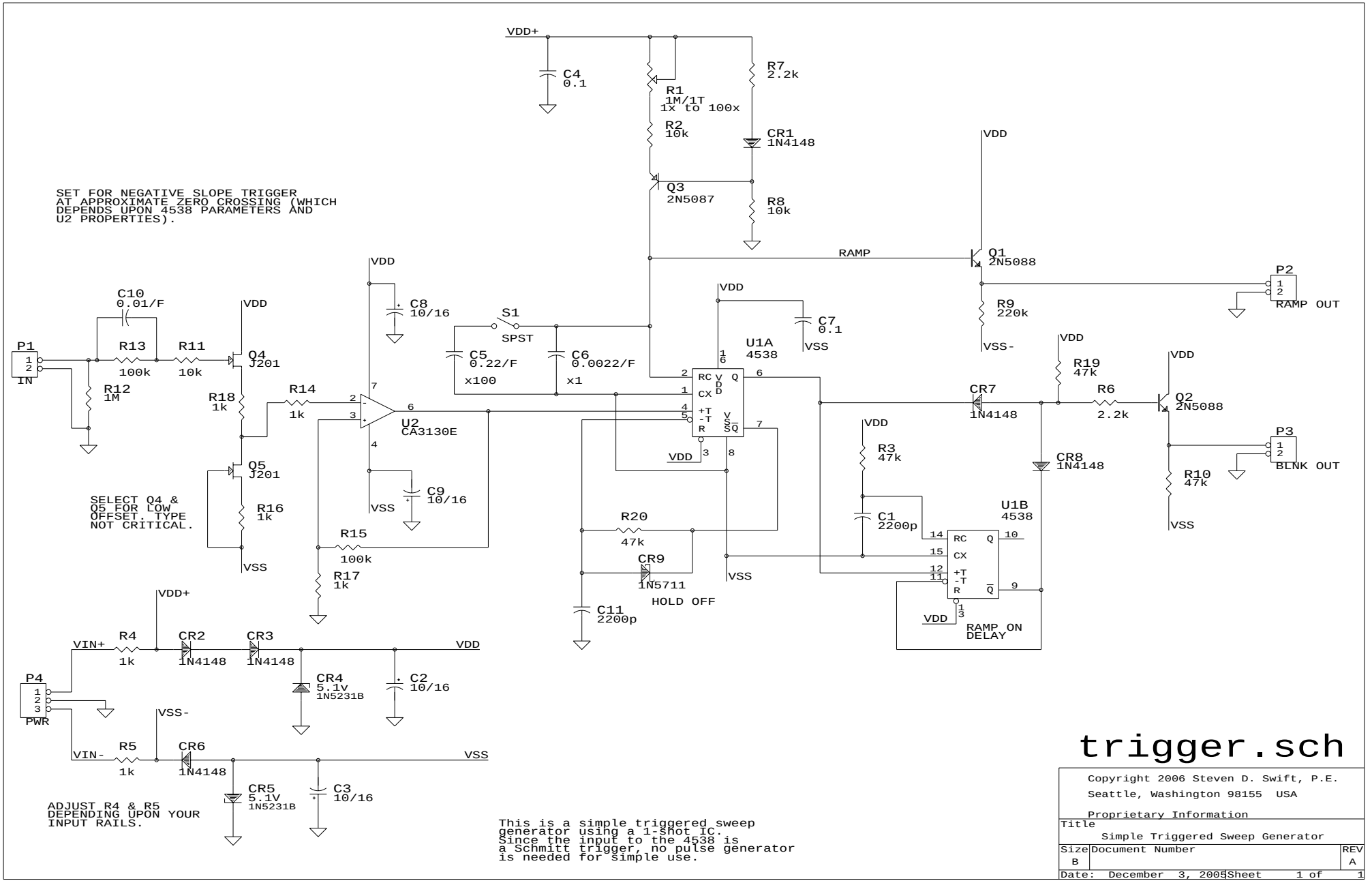
Most of the input circuitry is not needed if you pick off the trigger signal internal to an oscilloscope at a point with significant gain. The 4538B has built-in schmitt trigger inputs, so pulse forming isn't necessary. I added the FET voltage follower (Q4 and Q5) to allow a high impedance for small signals, if necessary. U2 is just an op-amp wired as a comparator with small hysteresis *(the CA3130E is most certainly not the best choice, but it is reasonably fast, has a CMOS output stage and my JB contained several)*. Since U2 inverts and trips near zero, this circuit always triggers on the negative edge of the input. A switch can be provided on the inputs to U1A to configure alternate polarities, but that was more than I needed. *(or as noted by Usenet follow-up posting, a nice comparator like the LM361 can be used, as long as the voltage levels are adjusted correctly).*

CR2 and CR3 are only used to give more headroom for the current source, *and CR6 provides ramp headroom (keeping Q1 out of cutoff)*. The input voltages are set as if they come from two nine-volt batteries, for external to the oscilloscope use. There's no reason that the rails cannot be modified to be single supply, or some other values up to the limits on U1 and U2. The ramp length is dependent upon the power supply, so it should be reasonably stable.

The circuit was tested on a "super strip" and then put onto a small circuit board (2.65" by 2").

This wasn't as simple as I hoped, but it will do the job for low frequency triggering. Your comments are welcomed.

Seattle, Washington


SET FOR NEGATIVE SLOPE TRIGGER AT APPROXIMATE ZERO CROSSING (WHICH DEPENDS UPON 4538 PARAMETERS AND U2 PROPERTIES).
SELECT Q4 & Q5 FOR LOW OFFSET. TYPE NOT CRITICAL.
ADJUST R4 & R5 DEPENDING UPON YOUR INPUT RAILS.
This is a simple triggered sweep generator using a 1-shot IC. Since the input to the 4538 is a Schmitt trigger, no pulse generator is needed for simple use.
VDD+
VDD
VSS
VSS-
C4 0.1
R1 1M/1T 1x to 100x
R2 10k
R7 2.2k
CR1 1N4148
Q3 2N5087
R8 10k
RAMP
Q1 2N5088
R9 220k
P2 RAMP OUT
C10 0.01/F
P1 IN
R13 100k
R11 10k
R12 1M
Q4 J201
R18 1k
Q5 J201
R16 1k
C8 10/16
R14 1k
U2 CA3130E
C9 10/16
R15 100k
R17 1k
S1 SPST
C5 0.22/F x100
C6 0.0022/F x1
C7 0.1
U1A 4538
R20 47k
CR9 1N5711
C11 2200p
HOLD OFF
R3 47k
C1 2200p
U1B 4538
RAMP ON DELAY
CR7 1N4148
CR8 1N4148
R19 47k
R6 2.2k
Q2 2N5088
R10 47k
P3 BLNK OUT
P4 PWR
VIN+
VIN-
R4 1k
R5 1k
CR2 1N4148
CR3 1N4148
CR4 5.1v 1N5231B
CR5 5.1V 1N5231B
CR6 1N4148
C2 10/16
C3 10/16
trigger.sch
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Title
Simple Triggered Sweep Generator
Size B
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REV A
Date: December 3, 2005
Sheet 1 of 1

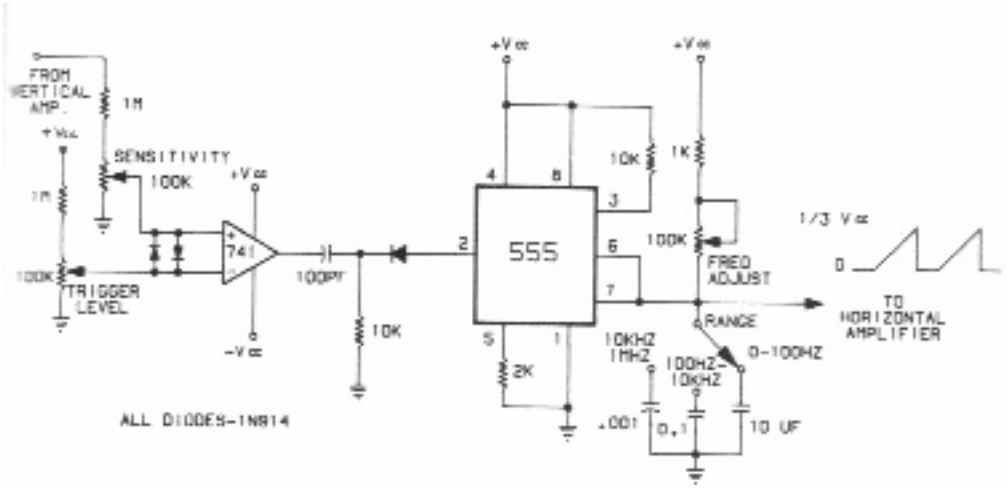

Figure 5-8. Reprinted from *Electronics*, October 11, 1973; Copyright © McGraw-Hill, Inc., 1973.